Digitized by the Internet Archive
in 2018 with funding from
University of Toronto

https://archive.org/details/medjournalJan1925uoft

The University of Toronto Medical Journal

VOL. II JANUARY, 1925 No. 3

EDITORIAL

ENCEPHALITIS LETHARGICA; SOME OF ITS PROBLEMS

THIS is the disease known to readers of newspapers as "Sleeping Sickness," and therefore sometimes foolishly confused by the laity, and occasionally by medical students, with African Sleeping Sickness, or Trypanosomiasis, of which all readers of boy's stories of adventure have heard. Encephalitis Lethargica is one of our "newest" diseases, and has therefore been attracting a great deal of attention recently. It is interesting because it is so little known, because its cause has not been discovered and because of its extremely varied manifestations and its characteristic sequelae. Of these sequelae as little is known as of any other aspect of the disease. Farquhar Buzzard, in the B. M. J. of November 22, 1924, suggests that the advent of the disease "may in the long run throw light on the etiology and pathogenesis of some obscure disorders of the brain, notable for physiological and physical disabilities". Of such, Paralysis Agitans, (Parkinson's Disease), and persistent myoclonic contractions, in many cases at least, are emerging as sequelae of Encphalitis Lethargica from the vast area of darkness surrounding the field of scientific medicine. Perhaps others may follow.

In addition to the acute form of the disease, there exists an ambulatory form, not at once incapacitating the pateint, but leading gradually to a degree of disability, great or small, and even to the sequelae known to follow acute attacks. Typically, if one may use the word in connection with this disease, such cases suffer a short illness of only a few days with slight fever and general pains, often not of sufficient gravity to force them to stop work, and very gradually after this neurological symptoms develop, revealing the nature of the disease. Finally, it may be after several years, the Parkinson syndrome is recognizable, the patient never having had to take to his bed. Buzzard claims that in the majority of such cases the disease may be diagnosed in its first onset, and that "in the majority of cases of ambulatory encephalitis, it is possible to obtain a history of some symptom pointing very definitely to organic disease of the nervous system, by far the most common being a transient diplopia which not infrequently is present only during a few hours or days." The diagnosis of Encephalitis Lethargica in any form seems to depend on a careful consideration of the history of onset, the course of the disease, and the exclusion of other pathological processes that may cause similar disturbances.

Another problem of Encephalitis Lethargica of the utmost importance is the question of the mode of infection. This problem must be closely related to that of the ambulatory form of the disease, for what if during the whole course of the disease, these often unsuspected cases were sources of infection to their fellows? It has recently been suggested that even in the late Parkinsonian stage the disease is contagious.

The probability is that Encephalitis Lethargica is not a new disease at all, but that it is new only in its epidemic form.

The attention of our readers is directed to Dr. Howland's article on Encephalitis in this issue, where a more complete discussion of the disease will be found.

ULTRA-VIOLET THERAPY AND TUBERCULOSIS

FOLLOWING the widely prevalent use of heliotherapy in the treatment of various forms of tuberculosis, attempts have been made to reproduce the effect by artificial means. It is obviously desirable to obtain the results of heliotherapy without the use of actual sunlight, especially in countries such as Canada, where good exposure to the sun's rays is uncertain and infrequent.

It is known that the ultra-violet portion of the sun's spectrum is much more important than other parts in the tanning of the skin, though light and heat waves do tan the skin to a certain extent. Pigmentation of the skin is very slow, however, when most of the ultra-violet rays have been filtered out with glass. Ultra-violet rays exert therapeutic effects in other conditions also, notably in rickets. It would appear that these shorter rays of the spectrum have the chief therapeutic effect in tuberculosis, though it can not be stated that longer rays do not exert some beneficial influence.

Recent work at Western Reserve University by Gerstenberger and Wahl[1] confirms the reports of others as to the clinical effects of Alpine light treatment of peritoneal, bone, glandular and pulmonary tuberculosis. Alpine light, so called, comes from a mercury vapor arc lamp, and is passed, not through glass, which would filter out the ultra-violet rays, but through quartz. These investigators report that peritoneal and glandular tuberculosis is quickly and markedly amenable to ultra-violet rays. In the space of two weeks the temperature comes down, and the patient feels better. Within six weeks the temperature reaches normal, and physical signs show improvement. It is, however, to be presumed that the more severe the condition the longer will recovery be delayed, and the more uncertain it will be. Likewise, bronchial lymph glands showed improvement under such treatment. Peripheral nodes, such as the cervical lymph glands, showed improvement, but not so marked as that seen in the deeper lymph structures. Bone tuberculosis also showed favorable progress.

Pulmonary tuberculosis, as might be expected from the results obtained through heliotherapy in this form of infection, shows little or no response to ultra-violet therapy. The cases reported, however, were miliary in type, a form rarely arrested by any therapeutic measures.

[1]Jour. Amer. Med. Assoc., 83; 1631. Nov. 22, 1924.

How ultra-violet rays act in these cases remains a complete mystery. That the effect is produced indirectly is suggested by the fact that ultra-violet rays penetrate tissue to a depth of only one millimeter or less, and by the fact that lupus vulgaris may be healed by exposing only parts of the body other than the areas affected. Possibly the blood stream receives and transports substances formed superficially by the action of the rays, and thus benefits deeper structures. The important fact remains, however, that apparently ultra-violet therapy is beneficial in glandular, bone, and peritoneal tuberculosis, and while the mode of action remains to be discovered, the empirical fact should be used in every way possible.

MEDICAL DISCUSSION GROUPS

THE chief problem in the education of the average medical student is to get him to discover and appraise knowledge for himself, and to use this knowledge in a practical way. It is not to fill him with facts and other people's opinions.

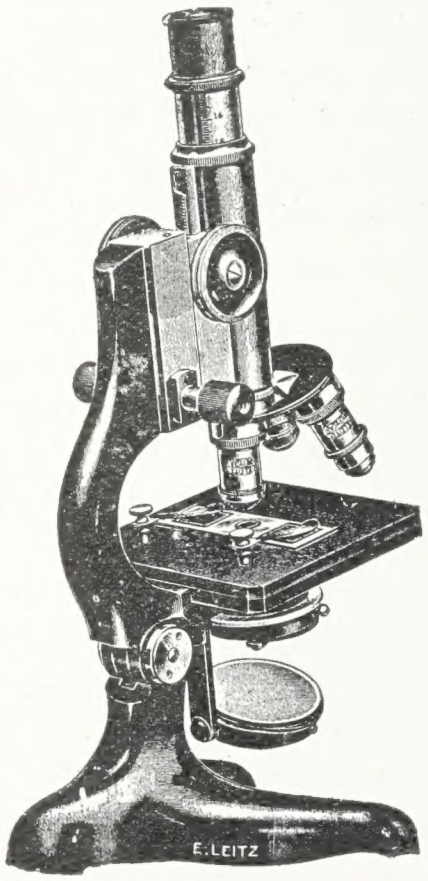
In the University of Toronto certain facilities are pre-eminently useful to this end. Chief among these are the medical discussion groups, of every name and sign. Whether or not a paper is of any value to those who hear it read, it is of very great value to him who prepares it, no matter what the subject may be. In addition to various reading clubs in the undergraduate body, the final year has no small number of papers to prepare in Surgery and Paediatrics. In addition, it is suggested that the Medical Society should concern itself with establishing groups for the reading and discussion of papers on medical subjects. That is a plan which is said to have worked well in the Old Country, particularly in the University of Edinburgh. We can think of no reason why it might not be tried here. But there are some factors which will tend to make a reading club or a discussion group successful, and a disregard of these factors will hinder the progress of the group.

In the first place, for free discussion, and an elimination of self-consciousness in the young speaker, the group should not be too large. We suggest twenty as being a good average number. Greater numbers than this tend to foster formality, and to spoil that freedom so essential to good discussion. Again, the members should be mutually adaptable. Congeniality will add a great attraction to the meetings, and help draw the members of the group out to the meetings. The social element is considerable, and can be made a great aid in the success of the meetings. The group, if possible, should be spontaneously organized. It should not be initiated by the staff, or unduly fostered by them. The moment the student feels he *ought* to attend a meeting which he doesn't *want* to attend, the project will probably fail. Finally, it is wise to invite one or two staff members to each meeting to assist in the discussion, and to help in the solution of any problems that may arise.

Such a small group, mutually congenial, spontaneously organized, will offer, we believe, unparalleled opportunities in the development of the medical man. Toronto medical students will be fortunate when several such groups are formed in each year.

LEITZ MICROSCOPES

The Standard of the World



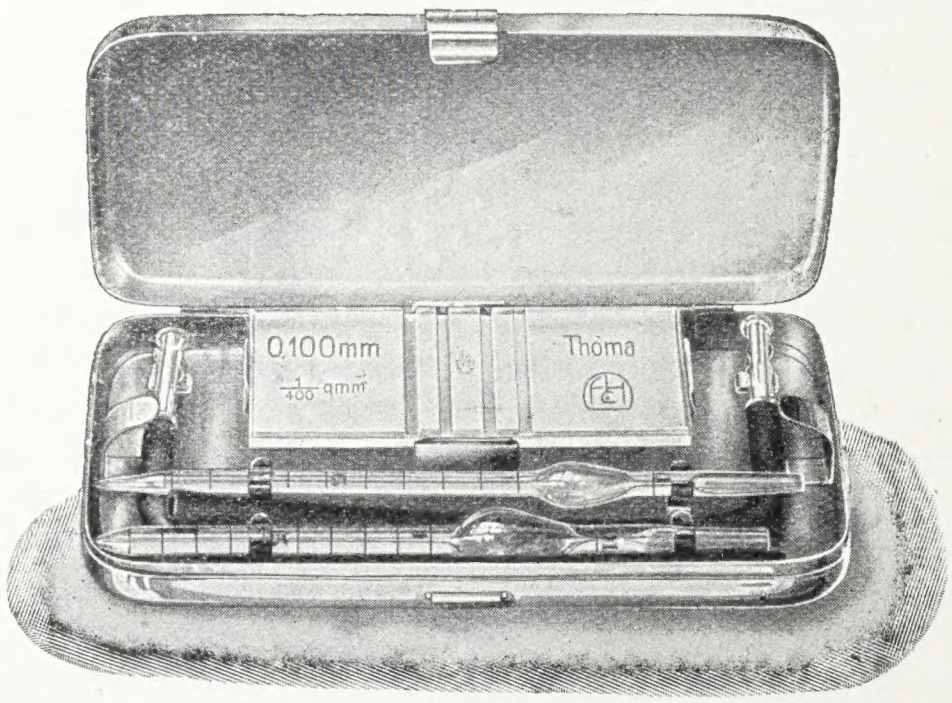
Physicians and Students
Model "L-10"

Coarse and Fine Adjustments
Abbe Condenser N.A. 1.20
Achromatic Objective No. 3 (16 mm.)
" " No. 6 (4 mm.)
" Oil Immersion $\frac{1}{12}$ (2 mm.)
N.A. 1.30

Huyghenian Eyepieces II (6x) and IV (10x)

Complete in Carrying Case
$125.00

Special Discount to Students



"Hartz"

Haemocytometers
Double Neubauer
SOLID RULING

Complete in
Nickel Plated Cases
$10.00

Special Discount to Students

Medical Books ***Surgical Supplies***

SOLE CANADIAN AGENTS

THE J. F. HARTZ CO. LIMITED

24-26 Hayter Street
TORONTO

24-26 McGill College Ave.
MONTREAL

THE PROPHYLAXIS AND TREATMENT OF TYPHOID FEVER

JAMES C. GOODWIN, '26

Based on an article by Rufus I. Cole, M.D.

Director of the Hospital of the Rockefeller Institute, New York

Typhoid Fever has been defined as an acute general infection, caused by the Bacillus Typhosus, characterized anatomically in the vast majority of cases by hyperplasia and ulceration of the intestinal lymph follicles, swelling of the mesenteric lymph glands and the spleen; and manifested clinically by continued fever, a rose-coloured eruption, a specific blood-serum reaction with typhoid bacilli, various abdominal, pulmonary, nervous, and other symptoms, and a tendency to certain complications, notably intestinal haemorrhage and perforation.

Typhoid Fever is very widespread, occurring in practically every part of the world. The incidence of the disease seems to be directly dependent upon the hygienic conditions—more especially, as related to the water supply. In nearly every case, epidemics are traceable to polluted water used for drinking, milk, and other articles of food, such as uncooked vegetables, oysters and other shellfish. The continuation of the endemic and epidemic occurrence of the disease seems to be largely dependent upon the direct or indirect transference of infected material from one patient to another—through the medium of the excretions of the infected person to the food or drink of the person attacked. The modes of conveyance of infection may be briefly stated to be through infected water, infected milk, by typhoid carriers, by flies, and through soil contaminated by excretion of the typhoid fever patient. The disease is most prevalent during the early spring, and in the autumn months, but it may occur at any time during the year. Although people of any age, or of either sex, may be attacked, young adults are apparently most susceptible.

The portal of invasion of the organism in typhoid fever is probably always through the gastro-intestinal tract, although some writers claim the tonsils represent a path of invasion in some instances. The bacilli, having gained entrance into the gastro-intestinal tract in ingested food or drink, are believed to invade the intestinal mucosa through a slight abrasion, or abrasions—generally in the small intestine. They proceed mainly by way of the lymphatics to involve the lymphoid tissue, in the lower part of the ileum generally. The Peyer's patches and solitary lymph nodes undergo hyperplasia, become inflamed, break down and form ulcers. The mesenteric glands, while these changes are going on, have been quickly invaded, and from these foci in the abdomen, the organisms gain access to the bloodstream, and set up a general acute infection.

The course of the disease varies considerably in different individuals, and in different epidemics, both in intensity and character. The disease may vary from a condition showing more or less fever over a few days only, to one characterized by continuous fever of great intensity and

lasting from six to twelve weeks or even longer. Associated with the fever may be observed a rose-coloured rash extending over the abdomen and chest—coming out in successive crops between the seventh and twelfth day, persisting sometimes till the end of the fever. The spleen becomes enlarged, and frequently the liver. The heart may show myocardial degeneration, becoming soft and flabby in some cases. The pulse rate is low in proportion to the degree of fever. Hypostatic pulmonary congestion is fairly common.

Associated with these clinical manifestations there exists a low leucocyte count. There is a positive B. typhosus blood culture for the first week, but after eight or nine days it is often impossible to find the organism in the blood stream, and hence it is useless to do a blood culture then. There is usually a positive Widal test ten days after the onset of the disease. The early diagnosis of typhoid fever is based on the cardinal signs and symptoms of high fever, low pulse rate, a low leucocyte count, and a positive blood-culture showing the organism B. typhosus.

The typhoid bacilli can undoubtedly remain quiescent in the body for a long time after recovery from the disease, being present in the intestine, gall bladder, or elsewhere, where they may give rise to local infection, or to one or other of the sequelae of typhoid fever; or by passing out in the dejecta, render the person a "typhoid carrier,"—a constant source of infection. Second attacks of typhoid fever are uncommon. The infection due to the paratyphoid bacillus may show clinical features characteristic of typhoid fever. The B. paratyphosus is closely related culturally and morphologically to the B. typhosus. While the pathological features differ slightly from those produced by the B. typhosus, the two conditions cannot be differentiated by clinical features alone, and the treatment should be the same in each case,—simply considering B. paratyphosus infection as a variety of typhoid fever.

The mortality rate is about 7-12 per cent. in hospitals, and even higher in epidemics, being dependent mainly upon the virulence of the organism, and the susceptibility of the patient. Death is due to the effect of the toxaemia upon the nervous system and the heart, or often to intestinal complications such as haemorrhage or from the results of perforation.

The treatment must therefore be directed toward neutralizing the effects of the toxaemia, the prevention or control of the intestinal complications, and the prevention of other complications, as well as relieving the symptoms associated with the disease.

Prophylaxis

In dealing with preventive measures relative to typhoid fever, it must be remembered that as far as known the bacilli leave the patient only in the excretions, sputum, urine and feces; and after leaving the body the bacilli generally do not live more than a period of from a few days up to a few weeks at the most—more commonly only 8 or 9 days; and that they do not thrive outside the body. It must also be remembered that the bacilli are taken into the body in the food and drink which have been contaminated by infectious material.

To guard against infection from typhoid bacilli, several procedures are open:

(1) Precaution to prevent access of infected material to mouth (*i.e.*, contaminated food and drink).

(2) Precaution to prevent spread of infectious material from the patient.

(3) Artificial immunization—to prevent infection in persons exposed to the contagion.

(1) The problems involved in the prevention of access of infected substances to the mouth belong rather to the subject of public hygiene. From the standpoint of public health, especially regarding typhoid fever, a pure water supply, inaccessible to contamination, is one of the most valuable and important possessions of any community—as it is mainly through the water supply that large epidemics owe their origin, in the majority of instances. Regarding individual prophylaxis during an epidemic, or at any time where there is suspicion of a contaminated water supply, the best procedure is to boil all water used for drinking purposes—no other method is as satisfactory. In regard to milk and milk products: if there is any suspicion of contamination of milk by infection, during an epidemic of typhoid fever especially, milk also should be boiled. The danger of paratyphoid fever is greater from milk and uncooked meat, probably much greater than that of typhoid fever. Wherever possible, food should be thoroughly cooked. The prevention of exposure of food to contamination by flies, especially during an epidemic, is also very important.

(2) The precautions necessary to prevent the spread of infected material, *i.e.*, excretions mainly, from the typhoid patient to the healthy person, directly concern the physician. As epidemics practically always arise from contamination of some largely consumed article of diet, chiefly water and milk, the chief aim in prophylaxis should be to prevent the distribution of bacilli, by destroying them in the excreta, as soon as possible after they leave the patient. The first step, as soon as the nature of the case is established, should be to isolate the patient, after reporting the case to the health authorities, so that personal disinfection and prophylactic measures can be more easily and efficiently carried out. Stools and other excreta of the patient should be thoroughly mixed with twice their volume of 5 per cent. carbolic acid solution, or a 5 per cent. solution of chlorinated lime, and must be allowed to stand for at least two hours. This disinfection should be continued until the 3rd or 4th week of convalescence, or, if possible, until several examinations have shown the excreta to be free from typhoid bacilli. In the disinfection of clothing, eating utensils, or any articles coming into contact with the patient, boiling, or the use of 5 per cent. carbolic acid solution is recommended. Carriers, *i.e.*, persons harbouring typhoid bacilli in their excreta later than 10 weeks from the onset of the disease, should be under the observation of the board of health, and should not be allowed to engage in any occupation requiring handling of food—as in dairy work especially.

(3) Artificial Immunization.—The value of vaccination has been fairly definitely ascertained. Considerable work has been done, dating back to 1895, when attempts were first made to produce, following inoculation, antibodies directed against the organism of typhoid fever

or its toxins. In 1895 Pfeiffer and Kolle in Germany investigated the effects of subcutaneous injection of dead typhoid bacilli in relation to exposure to typhoid infection. A. E. Wright of England followed up this work, and applied his technique of vaccination amongst Indian Troops, and also amongst the soldiers in the South African war. His method of vaccine preparation consisted in the following: bacilli were cultivated in sterile bouillon, and the bacilli were killed by heating to 60° C. before inoculation. Shiga, in 1904, endeavoured to remove the substances within the bacterial bodies which tend to produce active immunization when injected into the body, by making a bacterial emulsion of dead bacilli in sterile salt solution, and allowing the emulsion to autolyse for 48 hours at 37° C. The clear fluid obtained by filtering the autolysed emulsion was used for injection. Other methods have since been devised, but they are mainly based on these two methods of vaccine preparation.

In all instances the results obtained by inoculation must be judged not only by the appearance of immune substances in the blood of the persons inoculated, but by the susceptibility of the persons after inoculation, as shown by the incidence of the disease among these, as compared with that among the uninoculated population, exposed to the same conditions. From a study of statistics of the effects of vaccine inoculation among the British troops in the South African war, it may be shown that in every series of cases, except one, the incidence of typhoid fever in those inoculated was diminished by at least one half. These results were obtained at a time when vaccine administration conditions were not perfected to the extent now possible. In the recent World War, by the use of vaccines prepared by the method of Wright, the typhoid mortality was reduced to 0.04 per 100,000 troops, as compared with the typhoid mortality of 11.2 to 21 per 1000 in the previous wars of the last half century, where vaccination was not employed.

That vaccination affords protection, as a rule, for two or three years has been shown by fairly recent investigation. It is to be strongly recommended in the case of soldiers, travellers, persons much exposed in epidemics, nurses, orderlies, and all others who are in special danger of contracting the disease. The vaccine most commonly used for administration is such as may be prepared by the method of Wright. It is given in three doses: first, 500 millions of bacilli, then 1000 millions, and finally 1000 millions—given at intervals of ten days. It must be administered under aseptic precautions, by inoculation into the subcutaneous tissue over the back of the shoulder, or in the flank. Severe reactions (marked redness and swelling at the site of injection, malaise, chills, fever, muscular pains, vomiting, etc.) sometimes occur, but are exceptional in persons who are in good physical condition at the time, and who abstain from alcohol. It is better to avoid muscular exertion and exposure to the sun for 24 hours following inoculation. Vaccination has been proven to do no harm, although as a prophylactic measure it is contra-indicated in pregnancy.

Treatment

Specific Treatment

(*a*) Active Immunization.—The use of vaccines in the treatment of typhoid fever is still in the experimental stage, although shown to be of

definite value in the prophylaxis of the disease. Numerous reports on the subject have appeared during the last few years, but the results have not been generally accepted, and especially in some cases the results as shown by the death rate are not very convincing. All observers emphasize, however, the importance of early treatment and agree that vaccines properly prepared and administered at least do no harm. It has been recommended that an initial dose of 280-500 millions of bacilli (as prepared by Wright's Method) be injected subcutaneously, and followed by two or more doses, given at 3 day intervals. Lately fairly striking reports have been made, resulting from a series of cases treated by injection of sensitized bacilli (a mixture of killed bacilli and serums from typhoid convalescents).

(*b*) Passive Immunization.—Numerous attempts have been made, dating back a decade or two, to obtain specific sera, antitoxic and bactericidal, for the treatment of typhoid fever. Here and there strong claims have been made as to the good results obtained by the use of various serums, but these results have not been generally accepted.

General Management of the Typhoid Case

The case of typhoid fever always progresses better in a hospital than in the private home. In the former there is a better chance of recovery, as thorough nursing and treatment can be more easily and efficiently managed. Although it is always advisable to place the patient in a hospital as early as possible after the onset of the disease, it is far better to manage the case at home, if a long railway journey has to be undertaken before reaching a hospital. In private homes the most advisable plan is to imitate the hospital as much as possible. Where possible a trained nurse should be in attendance, or else some capable member of the family who can be depended upon to follow the instructions of the physician in charge of the case. Careful sterilization and disinfection must be equally thoroughly carried out whether in the home or in the hospital.

The first essential in treatment is absolute quiet and rest. Strict isolation is best in the early stages of the disease, and until the patient begins to convalesce the visitor list should be kept at a minimum. The patient should be constantly watched as to exertion; he should not sit up in bed or undertake to move himself at all until convalescence sets in. In view of the nervous and mental symptoms associated with the disease, conversation and reading should not be carried on. The room should be simple and plain. There should be no pictures on the walls, and the less the quantity of furniture and bric-a-brac in the room the better. Ornaments, pictures, etc., in some cases may be the source of mental distress and annoyance to the fever-stricken patient, and may even give rise to definite mental illusions. Typhoid patients show a tendency to become delirious at times, during the period of high fever, and steps should be taken to prevent any serious outcome, by close observation on the part of the nurse during these delirious attacks.

The room should not be kept constantly darkened, but bright sunshine should be kept out unless the patient's eyes are covered. The room should be cool and well-ventilated, and the windows must be screened to prevent spread of infection by flies. The bed should, if possible, be of the simple hospital variety, of iron construction, and at

least 28 inches from the floor. The mattress should be firm, and everything possible should be carried out to prevent bed-sores. The patient should be covered with as little as possible, preferably only by a sheet. The teeth should be cleaned daily, or if the patient is very ill, the nurse may clean the teeth, tongue and mouth with a suitable mouth-wash, using a piece of gauze wrapped around the finger as a swab. The lips should be prevented from drying and cracking by the use of vaseline. An alcohol rub is advisable once per day over the pressure areas on the skin. From the onset of the disease a very careful record should be kept as to the temperature and pulse, as these are very important indications as to the progress of the case.

The Diet in Typhoid Fever

A review of literature on typhoid fever up to a decade or so ago, even as far back as the time of Hippocrates, points out the fact that the most diametrically opposite modes of dietetic treatment have been employed co-existently—some physicians having starved their patients, others having fed them liberally, with all gradations between these extremes. Even at the present time there is no absolute uniformity of agreement in the minds of the profession as to the diet which should be employed during typhoid fever, but it is felt that a fair consensus of the opinion of the majority may be represented in this article.

However, before proceeding to a discussion of the diet advocated, it may be well to mention that a few years ago the usually stated requirements of a typhoid diet were that the food should be digested with the greatest ease, leaving behind the smallest amount of residue to form faeces. In the latter requirement there is no doubt that the knowledge of intestinal ulceration, haemorrhage, and perforation has been kept uppermost in mind. There has always been a tendency to simplify the diet more and more, and undoubtedly a simple diet of small proportions is the most easily handled by the body, and leaves little fecal residue. In support of a low diet advantages have been claimed, such as reduced gastro-intestinal disturbances, lessened nervous manifestations, and a lessened danger of intestinal complications. However, while these results are highly desirable, it has been shown, by a study of statistics of cases upon which low diets have been employed, as compared with those of cases treated with liberal diets, that such advantages may be equally claimed for the latter type of diet.

On this account the use of a diet of adequate caloric value has been advocated and on the following grounds:

(1) It is fairly evident that the marked loss of weight and strength from day to day indicates that the amount of food usually given is not sufficient to replace the tissue loss due to excessive metabolism during the fever; and that the need for nourishment is greater than normal during typhoid fever. Therefore in order to prevent diminution in weight and strength, the energy-supplying intake must necessarily balance or exceed the energy output occurring in the continued fever.

(2) With the increased diet the comfort of the patient is greatly promoted. Certain observers contend that the essential characteristics of the so-called "typhoid facies" are not due to the ravages of the disease, but to starvation.

(3) It has been proven statistically that the intestinal complications associated with typhoid fever are no more frequent in cases treated by a liberal diet of adequate caloric value than in those in whom the diet is restricted. The evidence so far in regard to the occurrence of intestinal haemorrhage and perforation apparently does not show that these complications are especially induced either by solid or semi-solid food. On general principles, however, it is believed wiser to avoid foods of excessive bulk, and especially those of high cellulose content.

(4) It is claimed that with patients on an adequate diet the convalescence is shortened; relapse is no more frequent, if as frequent; the post-febrile subnormal temperature is avoided; and lastly, the mortality is no greater—in fact considerable statistical evidence has been brought forward to show that it is not as great.

On this continent perhaps the first to advocate a liberal diet meeting the caloric requirements was Shattuck of the Massachusetts General Hospital, Boston, who used the following dietary in his treatment of typhoid patients: Milk, either hot or cold, diluted or undiluted, with white of egg, and tea, coffee or cocoa; malted milk preparations, gruels; albumin water with lemon juice; soft boiled or raw eggs; eggnogs; beef juice; finely minced lean meats, such as chicken, scraped beef, soft parts of oysters; macaroni; puddings; toast; apple sauce; ice cream. In Germany the diet advocated and employed by Friedrich Müller was one in which more liberal amounts were employed than were given by Shattuck. Besides one to one and a half litres of milk daily, he gives tender meats, hashed or scraped beef, finely chopped veal, chicken, game; potatoes; meal, flour, or rice gruel; spinach; apples; zwieback and dry white bread. He has been careful in avoiding the tendinous portions of meat, cartilage, and the hard indigestible portions of vegetables and fruits.

It is very important that in typhoid fever rules for feeding should be as strict as those which are laid down for the administration of medicines. The advisability of the employment of a more varied diet in typhoid fever must be decided at present upon practical and not theoretical grounds. A very important feature in the employment of the diet adequate to meet the caloric requirements of the fevered patient is that it should be carried out, when once undertaken, consistently and not by "fits and starts." This type of feeding requires definite supervision by the physician, and he should realize the necessity for leaving accurate directions daily or oftener, as to the exact kind and amount of food to be given to the patient. The physician must carefully watch for any signs of gastro-intestinal disturbance, and must take steps to prevent any serious complication—generally at the first sign of disturbance of function the diet should be restricted for a time to whey, albumin water, or some suitable light liquid food. It must be continually borne in mind that there are two distinct problems: first, the giving of solid food and a varied diet in order to make the patient more comfortable during the disease; and second, the giving of increased amounts of food constituents in order to reduce, or better, to prevent tissue loss during the disease.

Regarding Water Administration in Typhoid Fever.—Considerable experimental work has been done in connection with the giving of large

amounts of water in febrile and toxic disturbances and certain advantages have been pointed out. Besides the more efficient digestion and absorption of food, an important reason for giving large amounts of water in fevers, is that, in this way excretion is stimulated, and the elimination of toxins may be more favourably hoped for in the increased sweat and urine. When given cold it acts as an antipyretic. It is believed that the severity of the symptoms is certainly lessened when the typhoid patients take large amounts of water, and there is no limit to the amount which should be urged upon them. It is advisable that water be administered by the nurse, as a routine measure at frequent intervals, *e.g.*, every half hour—the amount given being all the patient can be urged to take.

Treatment Directed against the Infecting Organism

(*a*) Regarding enteritis and intestinal antiseptics.—It has come to be recognized that the intestinal lesions represent only one feature of the disease, and that typhoid fever is really a septicaemia—and also that the symptoms of the disease are due very slightly, if at all, to the absorption of toxins from the intestinal canal. Notwithstanding these facts various attempts have been made, and still are being made to some extent to treat typhoid fever by treatment of the local intestinal lesions, and to attempt to render the bowel less infected. Various drugs have been advocated by some, but it is certain that the power of these to render the intestinal canal aseptic is only very slight, if any, and for all practical purposes should have no place in the treatment of typhoid fever.

(*b*) Internal antisepsis. -Various drugs, such as quinine, silver compounds, such as collargol, mercury preparations, etc., have been advocated for the treatment of the septicaemia of typhoid fever. Without any further discussion of the drugs which have been employed for this purpose, it may be stated that at present there is no drug known which will definitely destroy or inhibit the growth of the typhoid bacillus in the body. The only forces of which we have any knowledge are the natural bodily forces of resistance, and there is no evidence that these forces are materially reinforced by drug administration, at least in the manner in which they are employed at present.

Treatment Directed to the Elimination of Toxins.—The majority of the clinical manifestations of typhoid fever are the result of the toxaemia following the general blood-stream infection by the bacillus typhosus. It is, therefore, highly desirable that our treatment of the disease should include the methods of toxin elimination from the body as a whole. Toxin elimination may be carried out in three ways:

(*a*) By the use of large amounts of water by mouth, as has already been discussed, as having a marked effect in the elimination of toxins in typhoid fever. In very severe cases water may have to be given in other ways than by mouth, *e.g.*, by the use of a stomach tube, rectal enemata, hypodermoclysis, and intravenous injection of normal saline or glucose solutions.

(*b*) External Hydrotherapy.—The elimination of toxins by way of the skin, in perspiration, is always more efficient if the skin is kept clean and healthy all through the course of the disease. The methods and further advantages of external hydrotherapy will be taken up in more detail under the heading of treatment directed against fever.

(*c*) Rectal irrigation.—This method should only be employed occasionally—never more than once per day. The procedure should always be carried out slowly and carefully. It is of some value in preventing accumulation of feces in the large bowel, and hypothetically is a method of toxin elimination. In all probability the main value lies in the fluid which remains in the large intestine, and the prevention of fecal impaction.

Treatment Directed against Fever

(*a*) By the use of antipyretic drugs.—Such drugs as quinine hydrochloride, phenazone, acetanilid, phenacetin, have been used to reduce the severity of fevers, but so far no drug has been found whose antipyretic effect is superior to that which may be obtained by the use of hydrotherapy, both internal and external.

(*b*) External Hydrotherapy.—It is believed that the fewer drugs given by mouth in typhoid fever the better. This is considered advisable in order to minimize any tendency toward gastro-intestinal disturbances. On this account external hydrotherapy has been conceded to be the method of choice in reducing or eliminating the febrile disorders associated with typhoid fever.

The methods of external hydrotherapy are devised toward the application of cold water to the exterior of the body, and the value depends greatly upon the manner of administration. The methods include (1) tub-baths, (2) bed-baths, (3) sprinkling, and (4) sponge-baths. In the first method the patient is carefully lifted into a portable tub at the side of the bed. The second method has been devised toward lessened movement of the patient, and consists in arranging a rubber sheet which has been placed under the patient, into the form of a trough by the use of pillows, bed clothing, etc.; and thus one can give a fairly good bath with very little movement of the patient. In the third method the patient lies on a rubber sheet, and cold water is sprinkled on him—fanning may help increase evaporation of the water and render the patient cooler. The last method consists in sponging the patient off with cold water. The first two methods are more efficacious, and in these the patient should be immersed in water as far as possible. It is customary to use the temperature of the patient as an indication for the necessity of bathing, and also as regards the frequency of the baths. If the body temperature is over 102.5° F., a bath every three hours is advisable, or every four hours using colder water. The temperature of the bath should be from 80-85° F.—or in more severe conditions 75° F. It is customary to give the first bath at a temperature of 85°, and if the toxaemia and the general condition do not improve lower the temperature and increase the frequency or even the duration of the bath. Ordinarily the patient should remain in the water about 10-20 minutes and then be transferred to a wet pack, of blankets, for 10-15 minutes—after which the patient should be rubbed briskly dry. The back, chest, and extremities should be rubbed vigorously for a short period of time to prevent chill. While in the water cold affusions to the head, neck, and chest are advantageous in stimulating deep respiration, as well as aiding in reducing the fever of the patient. In the methods of sprinkling and sponging, colder water should be used than that employed in the tub-bathing. These methods may all be modified within a certain range

under the direction of the physician, and depending upon the severity of the disease.

The Advantages of External Hydrotherapy

(1) The effect on the nervous system consists mainly in the prevention or lessening of any delirious tendencies, in the diminution of tremor, and in the production of a clearer mental condition. In the majority of cases severe nervous manifestations may be alleviated. The patients become quiet and even go into a restful sleep afterwards, at times. Rarely the so-called "typhoid state" is exhibited in patients under hydrotherapic treatment.

(2) Toxin excretion is increased.—As has been pointed out previously the elimination of toxins by way of the skin is greatly increased. This is inferred mainly from the fact that certain so-called toxic manifestations of typhoid fever show so much amelioration. The elimination through the kidneys is increased, mainly secondary to the effects of external hydrotherapy on the cardiovascular system.

(3) Temperature is reduced.—This effect is not the main feature of hydrotherapy by any means, as it is known that in many cases the effect on the temperature is minimal, while the general effects may be excellent. The value of external hydrotherapy in reducing fever should not be at any time minimized, however.

(4) Improvement of the circulation.—External hydrotherapy tends to produce a lower heart rate—the pulse becoming more like the normal. The B.P. may rise 15-20 mms. These features tend to produce a more efficient circulation.

(5) Effect on the respiratory system.—Lessens the tendency toward bronchitis, and also toward passive congestion at the bases of the lungs. The cold affusions especially stimulate deep breathing.

(6) Reduction in mortality.—External hydrotherapy results in the saving of many lives which would otherwise be lost as a result of toxaemia. Experience indicates that bathing has no unfavourable effect upon the mortality from intestinal complications, nor does it alter the frequency of relapse. It is questionable whether the average duration of the disease is affected.

Contra-indications to External Hydrotherapy.—Haemorrhage, indication of perforation, phlebitis, cholecystitis, great prostration, cases seen late in the disease, menstruation. Where collapse, abdominal pain, haemorrhage, vomiting or extreme cyanosis occur during the bath, the patient should be immediately removed.

Treatment based on Certain Predominant Symptoms.—In the relief of certain important symptoms, careful observation, and proper application of therapeutic measures is necessary. Not infrequently lives are saved which would be lost if certain symptoms were not relieved. The patient is rendered more comfortable, and often severe complications may be prevented by the taking of judicious precautions.

(*a*) Gastro-intestinal Symptoms:

(1) Constipation. Of all the gastro-intestinal symptoms, constipation is the most desirable. It is strongly believed that the quieter the bowels are kept the better. A dose of calomel at the onset of the disease has been recommended, but purgatives are distinctly contra-indicated after the first week. If constipation occurs, a small soapsuds

enema every second day will correct this difficulty. If the tendency is very marked, daily enemata may be required. The use of rectal enemata prevents fecal impaction, which, if it does occur, can usually be relieved by a high injection of about six ounces of sweet oil, followed in two hours by an enema consisting of six ounces of Magnesium Sulphate in a litre of warm water.

(2) Diarrhoea.—Much more difficult to control. When a patient is on an adequate diet it usually indicates a severe infection, or marked involvement of the colon. Regulation of the diet should be attended to first. If in the inspection of the stools curds are seen, dilute the milk given in the diet, or use whey—or even cut milk out of the diet for a time. If the diarrhoea continues it may be advisable to cut off food entirely for a day or so, giving only water, and when the condition has cleared up begin increasing the diet very gradually, using only egg albumin, whey, etc., at first. At the same time other procedures may be employed to relieve the diarrhoea. An ice bag over the abdomen may restrict peristalsis. Drugs may be administered by mouth although rarely required. Such drugs as Bismuth, Dover's powders, Tr. Camph. Co., Pil. Plumbi c̄ Opio, may be of some service. Hydrotherapy should not be discontinued—there is some good evidence to show that the bathing is helpful in relieving the condition.

(3) Tympanites.—This is not necessarily a serious symptom, but if it is observed in a severe form it may give evidence of extreme toxaemia and paralysis of the bowel. The condition should be treated in the early stages, or far better preventive treatment should be employed. The latter can be accomplished by strict attention to the details of diet and methods of toxin elimination, which should always be routine measures in typhoid fever. Tympanites is most often associated with diarrhoea, and it is also advisable in this case to cut off food for a time. With the disappearance of diarrhoea, the distention usually subsides. Frequent hot turpentine stupes over the abdomen are of value in moderate degrees of distention. 5-10 minim doses of turpentine by mouth, and a drachm in large enemas of warm water are also of value in the treatment of tympanites. The passing of a soft rectal tube high up in the colon may be required if the above methods are ineffectual. It may be left in for 15-20 minutes, or in severe cases of distention until the condition is relieved. In severe tympanites a subcutaneous injection of pituitrin, or eserin sulphate, may be employed with good results. Gastric distention is often associated with tympanites, and if the use of carminatives does not relieve the condition a stomach tube should be passed, to avoid cardiac embarrassment.

(*b*) Nervous Symptoms.—Headache is a fairly common complaint, and is best treated by the use of an ice cap, renewed frequently. Occasional small doses of phenacetin or aspirin may be of value. Nausea and vomiting are frequently of nervous origin, and may be relieved by gastric sedatives. General nervous symptoms are best treated by the methods of external hydrotherapy as mentioned above. Restraint in sheets may be required in cases of violent delirium. Morphia may be used in severe cases. Insomnia is usually relieved hydrotherapeutically. If it occurs after temperature has fallen to normal, a cold pack may be employed to overcome it. It is best to avoid giving sedative drugs by

mouth as much as possible. Prolonged insomnia may require hypodermic administrations of morphine.

(*c*) Renal Symptoms.—Bacilluria occasionally occurs, and is not at all uncommon. Urotropin 10-15 grains t.i.d. will aid in correcting the condition. Patients showing bacilluria should use sufficient urotropin to eliminate this condition for at least one month after leaving the hospital—or until the urine is free from bacilli.

(*d*) Respiratory Symptoms.—In the early stage of the disease bronchitis may be a fairly common occurrence. It does not generally require treatment other than routine external hydrotherapy, which also prevents hypostatic pneumonia. Strict attention to mouth and teeth will greatly prevent the occurrence of laryngeal complications. If the initial bronchitis is severe, expectorants may be used. If pneumonia occurs it should be treated as if it were primary.

(*e*) Cardiovascular Symptoms.—Typhoid fever is usually associated with a low B.P., due to lowered peripheral resistance and probably to a weakened myocardium also. The pulse is usually slow in the majority of cases. The physician should observe the B.P. and pulse from time to time. If the B.P. falls below that at which it has been running, and the pulse becomes rapid with a tendency toward irregularity, administration of strychnine is recommended—1/60-1/40th grain hypodermically. Other stimulants may also be employed. An ice bag over the praecordium may be employed. Alcohol has been given as a cardiac stimulant in these cases. If strychnine, alcohol, or hydrotherapy do not improve the condition, digitalin 1/40-1/30 grain hypodermically is recommended. Adrenalin camphor, or caffeine may also be used where there is definite myocardial impairment.

The Treatment of Complications.—The complications associated with typhoid fever have been classed into two groups—toxic and suppurative. The complications in most cases are due to the localization of the bacilli in the tissues, in one group it is difficult to demonstrate the organism, and the lesions do not suppurate; in the other their presence is more easily demonstrated, and the lesions are suppurative in character. The pyogenic complications are usually milder than those produced by pyogenic cocci, and are usually more chronic—surgical interference is not so urgent.

As a general rule in nearly every case the treatment of the complication should be similar to the treatment of the same condition if found unassociated with typhoid fever. This is especially true in such complications as skin lesions; infection of various glandular organs; abscesses of deeper organs; arterial and venous thrombosis; cholecystitis; pneumonia; pleurisy; meningitis and also pregnancy. In regard to gastro-intestinal complications, however, the attention mustbe drawn to two serious conditions which are liable to complicate typhoid cases, viz., intestinal haemorrhage following ulceration and intestinal perforation.

(*a*) Haemorrhage.—Profuse bleeding is indicated by a sudden fall in temperature, pallor, sweating, and a rapid feeble pulse, with extreme prostration. The haemorrhage, however, may not occur all at once, but on several occasions—here the condition is not so serious. When profuse haemorrhage is suspected the patient should be put absolutely at rest, the foot of the bed raised, and an ice bag placed over the abdomen. The food should be withheld temporarily. When the patient is very restless ¼-½ grain of morphin should be given hypodermically. Tr. Camph. Co is of value in diminishing peristalsis. Adrenalin should only

be employed in cases of severe haemorrhage. Compressing bandages may be applied to the arms and legs in profound anemia. Administration of stimulants is advised. Intravenous injections of saline have been employed, but better results are obtained by the method of blood transfusion. In cases where more chronic haemorrhage is suspected, the calcium salts, particularly calcium lactate, may be employed with a view toward increasing the coagulability of the blood. The general treatment of anemia may be instituted after the tendency toward haemorrhage has disappeared.

(*b*) Intestinal Perforation.—This complication is most liable to occur in cases showing marked symptoms of diarrhoea, tympanites and haemorrhage. Perforation occurs most commonly in the third week after the onset of disease, but may occur any time after the first few days. In usually every case sharp pain is the first symptom—often a change of expression to one of anxiety; chills, vomiting and sweating are frequently associated symptoms. The most marked symptoms are tenderness and muscular rigidity. Good results are very rare under expectant treatment. Operative intervention should be urged in all cases in which the patient is not obviously about to die. The most favourable period for operation is within the first 24 hours after perforation has occurred. Opium and the use of an ice bag over the abdomen may restrict peristalsis to some degree until operation. The result in the majority of cases which are not operated upon is peritonitis, which is invariably fatal—hence it is the duty of every physician to insist upon operative intervention as soon after the occurrence of perforation as possible.

Treatment of Relapse.—If an elevation in temperature occurs during convalescence, complication or relapse is to be suspected. In cases of true relapse the temperature remains elevated, not soon falling to normal again, as in a recrudescence. With the elevation of temperature similar to the first attack, the diet should be immediately reverted to that employed during the course of the initial fever, if the patient has been receiving a full diet in convalescence. The treatment of the relapse should differ in no way from the treatment of the initial attack.

Treatment of Convalescence.—The patient should be under just as careful supervision during convalescence as during the course of the disease. Careful attention to any symptom that may arise may prevent many of the more serious complications of typhoid fever occurring during convalescence, and especially in the earlier part of convalescence. In detecting complications in their earliest stages serious results can often be avoided.

As a rule, after the temperature has been normal for a week to ten days, the patient may be propped up in bed. About four days later, if the general condition continues to show improvement, the patient may be allowed to sit up. The return to the regular full diet should be effected gradually. A tonic, such as Syr. Ferri. Phosph. cum Quinin. et Strych., is to be advised during convalescence. A complete change of environment is often advantageous. The patient should be allowed to walk about, and take mild exercise after three weeks of convalescence. Three months at least should be taken before he should resume his occupation or attempt manual labour. By allowing sufficient time for the return to health and strength, in this way, the likelihood of late sequelae is materially diminished.

THE CAUSATION OF MONSTROSITIES

JAMES CRAWFORD WATT, M.A., M.D.

Associate Professor of Anatomy, University of Toronto

Any foetus which is deformed may be named a monster, or a monstrosity. Such individuals may show many grades of deformity, ranging from such minor changes as an alteration in the number of digits on hand or foot, to changes of such serious character that they are incompatible with life after birth and may even be the cause of the death of the foetus in the uterus. Many deformities do not interfere with the growth of the individual within the mother's womb, but are of such a nature that when birth occurs existence is no longer possible, with its now greatly altered conditions, and the individual dies. Examples of such a condition are to be seen in monsters in which a large part of the intestine is lacking, in others also where the head end of the individual is absent or nearly so, a condition known as anencephaly.

The production of a monstrosity is an event which is by no means uncommon. It is also not peculiar to man but is found in other forms of animal life and also in plant life. The occurrence of such an event has been noted by all classes of men, learned and unlearned, even to the most unlettered peasant whose domestic animals have sometimes presented him with such a phenomenon.

From a study of the records of 100,000 pregnancies Mall has found that there were 80,572 normal births, 11,765 abortions of normal embryos, 7,048 abortions of abnormal embryos and early monsters, and 615 monsters born at full term. This means that one child in every one hundred and thirty-two born at full term is deformed in some way or other, and also that there died early a great many other individuals (over 7%) who would have become monsters if they had continued their existence.

To enquire into the causes of a condition so prevalent is certainly worthy of effort, and scientific men of all ages in history have devoted their thoughts and energies to this task. A masterly review has been presented by Ballantyne of the very many opinions which have at various times held sway, and the few of real scientific value have been sorted out from the many which are inconsistent with the facts.

To the ignorant the occurrence of a monstrosity is something most mysterious, awe-inspiring and contrary to the laws of nature, and is therefore regarded in a superstitious light. This is quite true for our own period among savage races and was universally true in past ages for all mankind. Many records of the past taken from Chaldea, Greece, Rome and Egypt bear descriptions of monstrosities, and show how these misshapen individuals were ascribed to supernatural agencies and were looked upon as augurs, omens or portents of coming events. The events foretold by these messengers were many of them evil, and future wars, famines and other calamities were signified by the worst of the deform-

ities. From Chaldea has come a tablet bearing a long list of monsters with the significance of each, and forming the earliest known classification of them in history.

The gods were often ascribed as the cause of monstrosities and in a similar way evil spirits were credited with producing them. Ballantyne points out that some monsters appear to have been personified in myths and legends, a siren for instance representing a sympodial foetus, that is, one with the lower limbs fused. Atlas is supposedly derived from an example of occipital encephalocoele. Among other supernatural causes the sun, the moon, and the stars were very firmly believed in as producing malformations. This belief was at one time very widespread and was fostered by the astrologers, who had a powerful hold on the imagination of the people.

Among more natural explanations advanced by thinking men of early ages were changes in the paternal or maternal "seed" or in both of them combined. The nature of the changes, however, was unknown. This view, in the light of modern knowledge, is recognized as an important factor and will be reviewed later.

Changes in the germinal material of either father or mother, due to powerful mental impressions was a very ancient belief given as a cause for malformations in the foetus. This view was later extended to include the action of all kinds of longings and mental impressions of the mother at any period in pregnancy, and in this latter form it persists to the present day as a very widespread belief even among educated people. Sudden shock or fright is supposed to be especially potent in this regard. By believers in this theory deformities clearly produced in the first six weeks of development are ascribed to longings, obsessions or shocks experienced by the mother in the latest months of pregnancy.

Injuries to the mother from accidents have been invoked as possible causes of deformities of the foetus, and the view has been carried to absurd lengths, injury to any part of the mother, according to this view, affecting a similar part of the child, so that a mother's sprained ankle would directly produce the child's club foot. The child, however, is fairly well protected against direct injuries which might affect it from blows on the mother's abdomen. If the injury is serious enough to affect the child it is most likely to cause its death and produce abortion, not malformations. The same is true of tumors in the mother's abdomen, pelvis or uterus. If the child is affected it is usually by pressure preventing the growth of the uterus, and leading to the death and expulsion of the child.

Foetal diseases have been looked upon as active in producing abnormalities. Diseases of the foetus, however, are in many ways similar to those occurring after birth, and only cause pathological conditions of already formed organs, not changes in the development of those organs. It is admitted that some diseases lead to deformities by destruction of parts, but this is not monstrous or perverted development. As to diseases of the embryo little is known.

There is a fair amount of proof for the action of the amnion as an agent for the production of malformations in the embryo. An amniotic

membrane imperfectly developed, which fails to separate properly from all parts of the surface of the embryo, or a membrane which later contracts adhesions to the surface of the embryo's body, will by its presence interfere seriously with the growth of the part to which it is attached. Marked deformities of all parts of the body have been found associated with an amniotic membrane attached to those parts. Segments of limbs showing scarred stumps, and with the amputated part lying free in the amniotic cavity, have been noted in connection with encircling bands of adhesions. This cause, however, accounts for only a relatively small number of deformities.

When the methods of modern sciences began to be applied to the investigation of monstrosities, it was realized that by far the greater number of them could be traced back to changes in the embryo at an early stage of development. In the human individual this embryonic period consists of the first six to eight weeks of intra-uterine life. Ballantyne has emphasized that there is a tremendously rapid growth in this period, which comprises those stages from the union of the ovum and the sperm in the fertilized egg up to the beginning of the foetal period, where at least the rudiments of all organs are now present. Starting with the simple fertilized egg, the embryonic period ends with differentiation of all the tissues, and formation of the various organs of the body. The physiology of the embryo is thus seen to be that of organ formation.

From the eighth week to the end of pregnancy, that is during seven months, the main changes in the individual, no longer an embryo, but now a foetus, are mainly changes in the size, relative proportions and activity of the various parts of the body. The physiology of the foetus is therefore the growth and attainment of function of the various parts which were formed in the embryonic period. In some organs there may be a carrying on of the embryonic period beyond the eighth week, while in others like the heart there is an early attainment of function in the embryonic period, so that for some individual organs the generalized rule does not hold that the beginning of the foetal stage is between the sixth and eighth weeks.

It can now be seen that from injurious causes operating on the foetus there will occur disturbances of growth and function in various organs already formed, resulting in overgrowth, deficient growth, or defective function. The pathological manifestations will be similar to those that would be found in the same organ after birth. But from causes operating injuriously in the embryonic period there will result a derangement of organ formation and differentiation, which will produce true monsters showing parts in excess, parts defective and deformed, or parts absent. In this class will be found embryos lacking a heart or a head, with limb buds absent, with imperfect closure of the abdominal wall, with spina bifida, and a host of other malformations.

The application of the experimental method in the scientific study of the production of monstrosities in lower animals has brought forth a host of interesting results. Many investigators have been interested in this work and many different methods have been employed, which all have this one fact in common, that they cause a certain amount of

damage to the growing individual. Many of the fertilized eggs and embryos experimented upon die, those which survive the damage are malformed in various ways.

By mechanical means such as injury to the ovum, and also by separation of the two primary blastomeres, twins and also various forms of double monsters were obtained by Driesch, Wilson, Morgan, Conklin, Loeb and others. Either heat or cold was found quite effective in producing malformations when applied either to the fertilized ovum or to the developing embryo by Dareste, Hertwig, King, Alsop and Stockard. Ultraviolet light and the X-ray have been used with like results and Hertwig has employed radium similarly. Chemicals as teratological agents have been shown to be quite active by Stockard, Werber and others, who used alcohol, ether, magnesium salts, cyanides and various other substances. Hybridity by crossing distantly related species has been shown by Newman to produce monstrosities. It was found that the same type of malformation could be produced by all these different means, and also that usually many different deformities could be produced in a group of developing individuals by treating them by any one of the above methods. This clearly proves that no deformity depends upon any one particular agent.

It remained for Stockard, correlating his own admirable work with that of others, to point out that all the methods enumerated above have one common action on a developing egg or upon a growing embryo. The result of their use is to cause, at the time of their action, a more or less complete stoppage of the growth process. There is an arrest of development. In a growing embryo each organ or part has its own rate of growth, and these are not equal, but are all correlated and controlled so that growth is balanced and a normal individual is produced. If development is arrested, the rate of growth in all organs is brought to zero point, and on resuming growth all parts start equal, all balance and correlation is lost, and malformations result.

Stockard found that the easiest way to arrest development was to chill the eggs he worked upon for certain periods which did not kill them, but stopped all activity for a short time. A second very successful method was to deprive the eggs of oxygen for a limited period. On restoration to normal conditions development was resumed, but with an altered rate. By arresting development at different stages it was possible to obtain all the various types of deformity produced by any other means.

Stockard has also proved that there are critical periods for the organism as a whole, when interference with growth has much more serious results than at other times. Growth seems to occur in alternate periods of elevation and rapidity of change and of depression and slow change. Arresting development at the beginning of a period of elevation has marked results. The same facts are true as regards individual organs, and the period of rapid cell proliferation and differentiation occurring at the time when an organ is first forming is the most vulnerable time, when arrest of development will lead to the most marked deformity.

The most important period as regards the formation of the whole individual is the beginning of gastrulation. The main axis of the body is just being determined at this time and growth is concentrated about it, and secondary lines of growth are suppressed by the intense activity here. This activity is lost if development is arrested at this period, and on resuming growth it is possible for more than one main growing point to start, and so two main axes of growth may be produced and as a result from this stage two bodies will be developed about the two axes, and two individuals more or less completely fused will be produced, thus giving rise to various forms of double monsters. The degree of separation of the two individuals will depend upon how far apart the main axes of growth were. Some cases will show two heads on a single body, others varying degrees of separated trunks and limbs. Some will show very little union, thus giving rise to such cases as the Siamese twins. If the two axes of growth are completely independent then twins will result. This is one method of production of identical twins.

The above described process is actually utilized to increase the number of young in a litter in the armadillo. Patterson and Newman have found that in this animal one egg is fertilized, starts its development in the uterine tube and enters the uterus about the period of beginning of gastrulation. In the uterus the egg lies free for some weeks before it is finally implanted. During this period there is a complete arrest of development, and when growth is resumed there are eight primary axes of growth in the South American form, or four in the Texas species, each of which forms the start for a completely separate individual. Thus from one egg are produced either four or eight young, which are all of the same sex, and are identical in structure even to such fine details as the patterns and marks on their armour.

Monstrous development in chick eggs is explained by the fact that there is a decided drop in temperature when the egg is laid. Most eggs leave the mother's body at the end of gastrulation, but a certain proportion are just beginning or are still in process of gastrulation and from the temporary arrest due to chilling at this critical point malformations of various kinds result.

Now, in the human individual, chilling the developing embryo is not possible, so that arrest of development cannot be produced in this way. It is possible, however, to have growth arrested by a delay in implantation, and if this happens at a critical stage in growth, the result will be monstrous development. There are other ways also in which growth can be interfered with. Toxic substances in the mother's blood which are diffusible through the placenta may exert a poisonous influence on the embryo, depressing its activity. Lack of oxygen may be occasioned by a defective implantation, and lack of a normal food supply will also be occasioned thus. Such a lack will prevent growth occurring properly and may cause an arrest serious enough to produce monstrosities.

It was firmly believed by Mall that the large number of abnormal human offspring previously cited, 7,048 abnormal embryos aborted, and 615 monsters born at term in 100,000 pregnancies, was due to defec-

tive implantation in the uterus, and that this in its turn was due to an unhealthy condition of the uterine mucous membrane, which in many cases amounted to an active low grade inflammation.

There is still one factor active in the production of monstrosities which has not yet been touched upon. This cause operates even earlier than the embryonic period, and is known as the germinal factor, or heredity, as it exerts its effect through changes in the germ cells. This action may be brought about in two ways. First, the changes in the germ plasm may be inherited ones which have been transmitted through many generations. Numerous malformations have been described in which there is a history of the occurrence in the parents and grandparents also, and in collateral relatives as well, such as uncles, aunts and cousins. Secondly, the germ cells of one or both parents may be so damaged that the offspring will show malformations. Experimental work in this sphere has been done by Stockard and others, who damaged the germ cells of the parents by administering alcohol or other anaesthetics, and also various other toxic substances, with the result that a large percentage of offspring were born with deformities. Controls were used from the same stock and produced normal offspring.

In the human race damage to the germ cells may occur from the toxins of syphilis and other diseases, and from poisons of various kinds such as alcohol and lead.

The real and active causes of malformations may now be classified into four groups.

1. A very small group of cases resulting from foetal diseases, usually producing deformity as the result of destruction of tissue due to the disease.

2. A small group, but one in which the deformities produced may be of very severe grade, caused by adhesion of the amnion to some part of the body.

3. A moderately large number of cases due to inherited defects transmitted in the germ cells, and also to defects produced in the germ cells by damage from abnormal conditions in the body of the parent.

4. A group comprising the vast majority of cases, and due to some damage done to the embryo which causes an arrest of development with consequent malformation on resumption of growth. In the human individual this may be occasioned in two ways. First there may be delayed implantation of the ovum, or a defective implantation, either of which will produce faulty nutrition and lack of oxygen. Secondly, even a properly implanted ovum may be damaged by soluble toxins circulating in the mother's blood, which are capable of passing over to the developing embryo.

Finally, the question arises: How can the large percentage of monstrous births and abortions be decreased? One method of approach to this goal is a eugenic one. Both parents should be free from any strain of inherited defects. In the breeding of domestic animals this factor can be under thorough control. In human relationships, however, many individuals will refuse to be bound by such considerations. A second method of control might be called that of personal hygiene. The parents

should be healthy, and especially certain that they are free from the presence of all toxic agents in order to ensure that their germ cells are undamaged. There should be freedom from syphilis, lead poisoning, alcohol and other injurious substances for some time prior to conception. It is also of prime importance that the genital tract of the mother should be healthy, and particularly that the uterine mucosa should be free from catarrhal and other inflammatory conditions, so that implantation of the ovum may occur properly and the nutrition of the developing ovum be provided for efficiently.

REFERENCES

The mass of literature on the subject of monstrosities is enormous and only a few representative papers are listed.

Alsop, F. M. 1919. Anat. Rec. Vol. 15. No. 2.

Ballantyne, J. W. 1904. Manual of Antenatal Pathology and Hygiene. Green, Edinburgh.

Conklin, E. G. 1905. Journ. Exp. Zool. Vol. 2. 1905. Biol. Bull., Vol. 8. 1906. Roux's Arch. Vol. 2.

Driesch, H. 1895. Arch. Entwick, Mechan. Vol. 1.

Hertwig, O. 1898. Arch. f. Mikr. Anat. Bd. 51. 1911. Archiv. f. Mikr. Anat. Bd. 77.

King, H. D. 1903. Biol. Bull. Vol. 5.

Loeb, J. 1895. Arch. Entw. Mech. Bd. 1.

Mall, F. P. 1908. Journ. Morph. Vol. 19. 1917. Amer. Journ. Anat. Vol. 22.

Morgan, T. H. 1895. Anat. Anzeiger. Bd. 10.

Newman, H. H. 1917. Biol. Bull. Vol. 32.

Newman, H. H., and Patterson, J. T. 1910. Journ. Morph. Vol. 21.

Patterson, J. T. 1913. Journ. Morph. Vol. 24.

Stockard, C. R. 1909. Journ. Exp. Zool. Vol. 6. 1910. Amer. Journ. Anat. Vol. 10. 1921. Amer. Journ, Anat. Vol. 28.

Werber, E. I. 1915. Anat. Rec. Vol. 9.

Wilson, E. B. 1904. Journ. Exp. Zool. Vol. 1.

EXTRACT

The Contagiousness of Epidemic Encephalitis during its Parkinsonian Stage

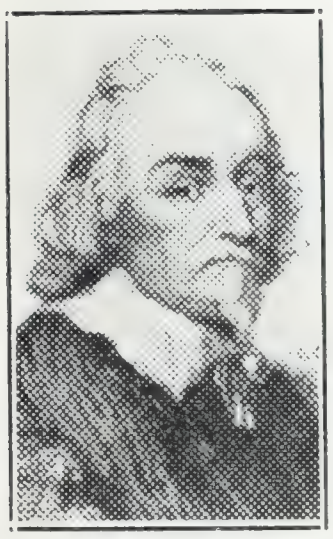
At the congress of French-speaking neurologists (Belgium), M. Guillain called attention to the fact that encephalitis should be regarded as contagious, not only during the first acute stage, but also during the Parkinsonian stage. He cited a case in which contagion had taken place through contact, and it seems probable that the virus of encephalitis may exist in the increased salivation of these patients.

J.A.M.A., Nov. 12, 1924.

WILLIAM HARVEY

1578-1657

By a Graduate



"Harvey was the man that invented the circulation of the blood." Before Harvey's "invention," the disciples of Galen believed that the blood was in motion but only as an ebb and flow,

"In motion still (a motion fix'd, not roving)
Most like to Heav'n, in his most constant moving."

Because the aorta was usually found empty post mortem, it was supposed that it contained air during life, hence its name. The word, artery (ἀρτηρια) was originally associated with the windpipe and was later transferred to the thick-walled blood vessels because they were thought to be air tubes. The blood was formed in the liver from food, according to the accepted teaching, and was carried by the hollow vein (vena cava) to the right heart. Here the crude blood was purified of its *natural spirits* in some unexplained way and became laden with *vital spirits,* being fitted now for its higher duties in the brain. Another metamorphosis was supposed to take place here, with the generation of *animal spirits* which existed apart from the blood and was carried along nerves to produce movements in the muscles.

The ancients thought that the blood "sweated" through the interventricular septum from the right side of the heart to the left, instead of circulating through the lungs, as we now know it does.

"As through a wall, with hidden passages slide,
Where many secret gates (gates hardly spy'd),
With convoy safe, give passage to the other side."

Servetus had pointed out the fallacy of this theory long before Harvey's time and had paid the penalty of teaching the unorthodox (in science and theology) by martyrdom at the hands of Calvin.

The heart relaxed in diastole in order to draw air from the lungs, lessening the heat generated in the heart and cooling the passions.

"Within this city is the palace fram'd,
Where life, and life's companion, heat, abideth;
And there attendants, passions all untam'd;
(Oft very hell in this straight room resideth)
And did not neighbouring hills, cold air inspiring,
Allay their rage and mutinous conspiring,
Heat, all, (itself alike) would burn with quenchless firing."

When a man "got all heated up," he breathed faster to cool off his blood and his anger.

Such had been the teaching for centuries, when William Harvey appeared on the scene. He was born at Folkestone on April 1st, 1578. (Some of his biographers would have him born on the second day of April, fearing that All Fools' Day should lose its character by giving birth to a great man.) Among the several homes—three at least—that claim the honor of having been his birthplace, the one called Harvey House is of special interest to Canadians, because its present occupant, Dr. W. T. T. Crawford, is a graduate of Western University Medical School, London, Ontario. Since Harvey's time this house has been remodelled, although there remains an underground passage from the wine cellar to the quay—a relic of the day when it was a virtue or a necessity to avoid the excise man. (It presents possibilities if the present temperance movement continues).

Harvey received his premedical training at Caius College, Cambridge. (You pronounce Caius as if it were spelled Key's.) In 1597, at the age of 19, Harvey began his medical course at Padua, Italy—the Padua that is associated with Shakespeare's skilled jurist, Portia. It boasted of such famous teachers as Vesalius, the father of anatomy; Fallopius, immortalized by the term, Fallopian tube; also Columbus and Fabricius. Harvey undoubtedly received as an undergraduate the traditional teachings regarding the circulation (or rather the non-circulation) of the blood.

Immediately after graduation he commenced to practise in London, and like many another fearless young graduate, he got married. Little is known about Harvey's wife, because he is all but silent about her, although he does mention that she had a remarkable pet parrot. She must have been an exceptional woman because the doctor's brother, John, left her £50 in his will.

In 1615 Harvey was chosen to deliver the lectures on anatomy and surgery at the Royal College of Physicians. In those days such annual events were attended by the public, partly perhaps out of curiosity to see the dissection of a body of a criminal. Pepys, in his diary, tells us that the lecture that he attended was followed by a sumptuous banquet—a thing of delight to the immortal Samuel. Harvey for years had been making a series of careful experiments and accurate observations on the circulation of the blood in animals. King Charles had been his good friend and had placed at his disposal many of the animals in the royal parks, but he began to think with Fracastoro that God alone could comprehend the motion of the heart,

> "Which full to know, were knowledge infinite;
> How the shou'd my rude pen this wonder write,
> Which Thou, who only mad'st it, only know'st aright?"

The heart beat so rapidly, "coming and going like a flash of lightning," that he could not follow the contractions of the auricles and ventricles. Finally he was able to prove conclusively that the blood circulated, as we now understand it. He demonstrated this new conception of the heart's function for over 10 years before he published his book, "De Motu Cordis et Sanguinis in Animalibus." (The Everyman's Library

has a cheap English translation of this classic and every medical student could read it with profit.) Evidently the passion to rush into print to establish priority was not as great in those days as it is with present-day scientists. In 1628, at Frankfort, was published this small quarto, "which compressed the greatest of all medical works into 52 pages"—a marvel of conciseness, in marked contrast to the deluge of words that characterizes modern publications. "I could have made it," he tells us, "into a large volume by quoting the names and writings of anatomists, or to make a parade of the strength of my memory, the extent of my reading and the amount of my pains." (Would that other authors had followed Harvey's example and omitted pages of bibliography that is often far from accurate!)

What were some of the effects of the public pronouncement of this new teaching? Some thought he was "crack-brained," others would not give thruppence for his bills (prescriptions). His practice "fell off mightily." The treatment of the sick was no different from before. Research, as ever, must have a practical application, if it is to receive immediate public recognition. Harvey had the satisfaction, however, of knowing during his lifetime that his teaching was almost universally accepted by the scientific world. He died on June 3rd, 1657, in his eightieth year, having won a place for himself with the immortals.

REFERENCES

M. Foster—History of Physiology, 1901.
Phineas Fletcher—The Purple Island, 1783. Canto IV.
R. Willis—The Works of William Harvey, 1847.
P. A. Robin—The Old Physiology in English Literature, 1911.

STILL TRUE

"If the modern surgeon is vexed to hear that surgery is, as Galen declared, but a method of treatment, he is vexed by a truth which in the best interests of our own profession, he ought to welcome."—William Harvey (1578-1657).

CORRECTIONS

The following corrections should be noted in the article by Dr. A. H. Graham on scarlet fever, published last month:—

Page 65, line 10, which reads "from other sources easily" should read "from other sources rarely".

Page 68, line 7, which reads "by cultures of morphological characteristics", should read "by cultural or morphological characteristics".

Page 68, line 11, which reads "index of immunity susceptibility", should read "index of immunity or susceptibility".

THE SYMPTOMS OF ENCEPHALITIS LETHARGICA

GOLDWIN W. HOWLAND, M.B. (Tor.), M.R.C.P. (Lond.)
Assistant Professor of Medicine, University of Toronto

A few years ago, this disease was not separated from the various types that were placed under influenza, and the question arises as to whether this infection is entirely a new malady, or whether it was always existent but not recognized.

The onset is so very varied, the course so erratic, the varied symptoms so very diverse, and the prognosis as to cure, relapse, and permanent defect so impossible to declare beforehand, that the physician has to use the utmost care from every standpoint in giving his opinion.

Frequently the patient complains of a simple neuritis lasting a few days or longer, with pains of all degrees of acuteness down the arm, leg, or head, frequently accompanied by hyperaesthesia. After a few days' care there appear other signs, that show that the original neuritis was but the signal of a greater attack on the nervous system.

Frequently the history is influenza, some slight nasal infection, chilliness, and then usually a period of a few days, when other symptoms appear.

Or, with startling suddenness, the patient falls in an apparent paralytic attack, or has acute head signs, and the diagnosis is entirely missed, being almost impossible, since an ordinary hemiplegia fills the symptom complex.

It is not possible to describe the disease in a simple manner, as each year the strangest types are appearing to add to the difficulties of the doctor, so that one is inclined to say that in the presence of acute infections involving the nervous system, *always exclude the possibility of Encephalitis Lethargica.*

(a) The *Meningeal* type is characterized by the presence of some rigidity of the neck, and by a slight Kernig; frequently the latter is hardly noticeable, and the examiner may feel that it is absent, or there may be a feeling of tension in extending the leg on the thigh, while there may be little, if any, pain beyond that normally complained of by healthy people. Headache may be very severe or slight, and replaced at times by giddiness. Lumbar puncture may reveal that there is a haemorrhagic type of disease present, or it may be clear, and give a cell count of 15 or more lymphocytes and a slight increase in globulin.

(b) Probably there are more mistakes made over the types associated with *Psychical disturbances* than any other group. The attendant physician is called to see a man with hallucinations of sight or hearing, or with a delirium in which the sufferer attempts to go to his regular avocation, although to the observer he is extremely ill. In this occupational delirium he attempts to leave his bed and resists obedience to the nurse. Under such circumstances, or when there is a wild attack of

mania in evidence, or the patient exhibits all the negativism or catatonic behaviour of a deteriorating dementia praecox, it is only possible to consider the possibility of the case being Encephalitis Lethargica, especially when some other symptom is present to balance the diagnostic difficulties, and to allow the mind to recover from the far more likely proposition, that the patient has a simple psychosis or a deteriorating mental state.

(c) The disease at times is *predominantly cortical,* when usually over a period of a few days there develops a monoplegia of arm or leg, with, as a rule, very poorly developed reflex signs, though usually the abdominal reflex is negative or the extensor of the great toe plausibly present. With a double-sided attack there may be difficulty in speech and swallowing of a pseudo-bulbar type, and a variation in the paralysis of both arms and legs, so that one may predominate over the other. Or the occipital cortex may afford the invasion room, and there develops a hemianopia of homonomous type, frequently with sluggish response of eye reflex, betokening that the lesion is even more widespread.

(d) The most peculiar case of Encephalitis Lethargica that entered the hospital was accompanied by signs of *implication of the Optic Thalamus,* with a moderate right hemianaesthesia, accompanied by attacks of agonizing pain in the affected arm and leg. This case continued to suffer for weeks and finally was fatal. Encephalitis Lethargica in the region of *the Lenticular nucleus* may be said to have two main types which probably are located in the neighbourhood of these big nuclei. These are the choreic group, with the typical bizarre movements of that common disease, and the type where there is extreme rigidity of arms and legs, varying in degree, on the two sides of the body, but which shows neither extensor response nor marked reflex change, a true extrapyramidal state. These cases cause the very elect to be confused as to their cause, and often the tremors associated with the rigidity in the arms and legs varying from the slightest unsteadiness to the most typical paralysis agitans-like movemnt, instead of helping one to a conclusion, only make the matter less certain.

(e) *Cerebellar-like* asthenia and extreme ataxia of the arms and legs following after a few days' illness, with one hand so ataxic that it was impossible to touch a given point, and legs equally unsteady, and absolutely forbidding walking, made the picture in one young boy. These are apparently the rarest of all types and the most alarming to the parents.

(f) A young woman had some slight pains down the backs of the legs. In a few hours she had developed numbness up to the waist, and a few hours later the legs were completely paralyzed, reflexes gone, with a complete lesion which paralyzed bladder and rectum. But the simple diagnosis of *Myelitis* was, in a day or so, replaced by that of sleeping sickness when the final details of the case topped the diagnostic horizon.

(g) There have been from time to time cases where all four extremities were involved, but the paralysis was essentially of the arms below the elbow, and the legs more severely affected in their muscular actions below the knees; the anaesthesia similarly was practically complete towards the feet and hands, but gradually became less as the observer

tested the skin nearer the trunk. No bladder or rectal difficulty presented itself. Such a diagnosis one would at once claim as *Peripheral Neuritis* of the generalized type, but the onset of double vision and somnolence cleared the diagnosis.

(h) It has seemed wiser to leave the most usual point of attack of the infection until the last, and one must now evidence the fact that the *brain stem* is the usual site. It is almost a law that most cases of the disease show some implication in this region. Be the case Meningitic, Encephalitic, Basal, Myelitic or Neuritic, it is the appearance early or late of a brain stem symptom, that usually leads the physician to a correct diagnosis, and away from the more simple one that he made at first from the signs that were presented. Double vision, passing away in a few hours, or remaining throughout the disease, or at times permanently established, due to implication of various combinations of the Third, Fourth and Sixth nerves, is the common symptom of all. Ptosis of both eyelids, or of one, some failure in reaction to light, or a pupillary change in size, or if one follows the foci to the Pons, the occurrence so frequently of a single or double facial paralysis, accompanied by a failure to outstretch the tongue, as the condition advances to the Medulla.

Again a very diagnosis-defying group are those which are due to implication of that sector which causes the student's mental dismay, *the Vestibular-auditory centres,* when the deafness, giddiness, vomiting and nystagmus lead one to conjure up the possibility of all sorts of Pontine angle tumours growing on the branches of the nerves in that region.

To this great wealth of clinical possibilities there is added the fact that *Lethargy* accompanied the disease so frequently in the early epidemics, that the diagnosis rested largely on the lethargy, but so infrequently in these latter years that waiting for the lethargy to appear only makes one miss the correct decision.

Encephalitis Lethargica was baptized by a most unforeseeing prelate; the name confuses the reader with the sleeping sickness malady of the African regions, to which it is related neither by germ nor origin, and it also gives the impression that the disease is wholly a cerebral one, whereas as one easily sees, it is widespread in the nervous system, islanded in brain, spinal cord and nerves. The proper name although a lengthy one should be *Infective Meningo-Encephalo-Myelo-Neuritis.* The question is often asked, "Does optic neuritis assist one in separating this disease from tumour, or from abscess, with which it is frequently confused?" One must answer, "No." Optic neuritis may occur in the disease, due to an infective process in the optic nerves themselves, but it does not advance to choked disc. The difference is one of degree only.

There are also manifestations in the sympathetic, but they are difficult to recognize. The peculiar twitching of isolated muscle bundles, chiefly in the abdomen or neck, and frequently rhythmic in character must be called attention to, although not sympathetic but spinal in origin. One should also mention the diaphragmatic hiccough that is at times present.

The spinal fluid is not a great aid to diagnosis. In these cases it is usually clear, with a cell count of 7 to 15 lymphocytes, and a slightly increased globulin content. The blood gives a white count of anything

from normal to some figure below 20,000. The temperature is absolutely unreliable, as it may be normal and the patient acutely ill. Perhaps this fact is an aid to diagnosis. However, it may show slight elevation, or it may be around 103° or higher for a week or so, but usually tends to reach a mild elevation of about 99° to 100°. One case ran about 103° for ten days and dropped by crisis (a most unusual thing) and then stood at a point about 99.5° for a couple of weeks before reaching normal.

The disease over, the patient may recover, although the mortality is about 25 per cent.; but after recovery, many relapse, and a second siege may follow, or even a third or fourth. But worse than relapse is the path of destruction left by this disease, as in many cases, especially in children, the brain is permanently damaged. Mental defect follows in some, and permanent motor paralysis, paralysis agitans, and emotional attacks of laughing or crying in others, while the spinal and neuritic cases may recover in part, or be almost totally incapacitated.

This description, while incomplete, gives a history of the symptoms that may make the reader realize the care that is required absolutely to rule out Encephalitis Lethargica in acute affections of the nervous system.

PATHOLOGIC INDIVIDUALS AND THEIR STATES

Florence E. Perry, '25

What constitutes a pathological individual? Generally speaking he is one whose behaviour does not conform to that which the majority of people decide is normal.

The behaviour of each individual is based upon four different types of reaction to his environment. The lowest, most primitive type of reaction is the reflex. Sensations are received and these are responded to by an action which is purely reflex in type. The next is the instinctive type where the sensations come, are registered as perceptions and become stored away as memories. Instincts then guide the response made to these perceptions and a motor act results. Higher still is the type where thought processes are of great importance. In addition to the sensations, perception and memory one develops a series of thoughts or ideas which leads to the building up of a field of imagination. Accompanying the imagination there is an emotional feeling. Both are dependent upon perception, yet each stimulates the other and the outcome is an action. Highest of all functions is that belonging to reason—the power of concentration and inhibition. Without this type of response well developed, one can readily see that imagination and emotion might lead to actions which would be inimical to the individual or to society as a whole.

It is exceedingly interesting to classify individuals, according to their type of reaction in the third plane where the thought processes are dominant. Here we find that individuals may be divided into at least four groups:

(1) The Anxiety Type.
(2) The Psychasthenic Type.
(3) The Paranoid Type.
(4) The Hysteroid Type.

The anxiety type of case receives his sensations in the usual manner. His perception is normal but he fails in his ideation process. He cannot concentrate on one idea, and act accordingly, but many ideas have equal prominence. He is confused. He becomes uncertain about his actions, and on this account he experiences the emotion of anxiety.

The psychasthenic seems to be a grade lower in his type of reaction. The emotion he experiences is one of fear. In some instances, the ideation so formed becomes an obsession which may lead to an imperative action. It seems to many that these two types differ from one another only in degree, and that an individual might pass from one type to the other, under certain circumstances. On account of the confusion and doubt in the mind of the psychasthenic, he naturally thinks when things go wrong that he made a wrong choice in the idea upon which he acted. He ought to have done otherwise—it was his own fault—his own mistake. Another individual would, of course, have acted differently and correctly under the circumstances. This builds up the idea that he is wrong, others always right—and he develops into a shy, retiring, self-depreciatory type of individual.

The paranoid is an entirely different type. His reaction to the group of conflicting thoughts is to seize upon any one—it matters not to him whether it is the wisest choice or not, upon which to build up his ideation and to act upon it. Moreover, he has the unshakable feeling that his thought and action are based upon the soundest judgment. If things go wrong others are to blame. If others do not agree with him—they are wrong. On this account he soon begins to feel that the majority of people are opposed to him. He then becomes suspicious of others, which is his outstanding emotion. His ego becomes that of the self-appreciative type.

The hysteroid individual seems to be of a very distinct type. Sensation and perception are normal, but there seems to be a magnifying-glass between these and the volitional act. The ideas are enormously expanded in the field of the imagination. With the expansion of the ideas there goes an increase in the accompanying emotions, and the act which follows appears to be based purely on imagination.

Individuals cannot be successfully typed unless they are abnormal at the time, that is, unless the individual has his power of concentration and control much lessened, or unless the individual is a child whose powers of concentration and inhibition are not yet fully developed. It is for this reason that a normal individual seldom agrees to being placed by others in a certain group, for he realizes the amount of inhibition he has to exercise in order to make his action conform to what he knows it should be, rather than to what his typical ideation and emotion would have caused it to be. The psychasthenic realizes that he is controlled by the emotion of fear. He is shy and inclined to be self-depreciatory, so he schools himself to perform acts which will cover his native tendencies, and the casual observer remarks, "Oh! he is of the paranoid type." Similarly the well-controlled hysteroid might assume the character of the anxiety type.

However, when an individual consults a physician, there has usually been sufficient mental or physical strain to weaken the control of the higher powers, so that after a short period of conversation, the patient's type can be correctly ascertained.

Pathological or abnormal people then, are those belonging to any one of the above four types whose powers of concentration and inhibition of thoughts are so weakened that in the majority, if not in all their acts, a typical form of response can be obtained. The mental defectives can then be classed as abnormals. Also adults of high mental calibre who, temporarily or permanently, have lost control of their thought processes. This leaves us uncertain only about the normality of children, where we have to decide whether the child has a normal amount of concentration and control for his age or not. It is possible to think of normal adults as those who successfully keep their type concealed. The abnormals are unable to do this.

As soon as an individual becomes abnormal he passes into a state which may be either a deteriorating or non-deteriorating one. There are three non-deteriorating states. These constitute the neuroses.

(1) Neurasthenic or Asthenic.
(2) Sympathetic.
(3) Disassociational.

If one of these states persists in an individual he himself or his friends will insist on his consulting a physician. But many times the person has sufficient insight into his condition, or the state has not become too fixed, so that he is able to depart from it and become the normal person again.

In the neurasthenic state the patient becomes hyper-conscious of his sensations. He may be hyper-conscious with regard to the external world or the internal world. Instead of a continuity of new ideas springing up, the patient keeps going back to thoughts which he has had before. He is in the realm of reverse thought. This initiates the habit of brooding. Brooding lessens his ability to accomplish things. He becomes asthenic. The emotional element becomes exaggerated and the patient becomes depressed, cries frequently and without real cause.

In the sympathetic state there is hyper-consciousness, reverse thought, asthenia and increased emotion. Only here the emotional overflow travels down the sympathetic, causing such disturbances as increased heart rate, rapid breathing, frequency of micturition, indigestion, vomiting, constipation.

In the third state, the disassociational, the patient, in addition to the character of the neurasthenic state, broods to such an extent that he adopts an obsession. The obsession may be any one of the four forms:

(1) psychomotor
(2) psychosensory
(3) psycho-ideational
(4) psycho-emotional.

In the first type the patient might believe that he had injured his arm. It then become impossible for him to move it. This recalls Sir J. Paget's statement: "The patient says that he cannot, the nurse says that he will not; the truth is that he cannot will."

The second type is the psychosensory. The obsession here is one associated with sensation. The patient has a feeling that his arm is numb. Sensation is lost, and he will not complain of safety pins being fastened through the flesh. Moreover, there is no bleeding.

The psycho-ideational form is the true obsession, where the obsession is an idea which has been brooded over to the exclusion of all else.

Lastly, there is the psycho-emotional form, where the obsession calls forth an emotion of unusual type or magnitude.

Any one of the different types of people may pass into any one of these states, but the psychasthenics and hysteroids more usually get into the disassociational state than into any other. The anxiety type most frequently goes into the asthenic state, while the paranoid is as likely to pass into one as the other.

Having dealt with the neuroses, the states which we now consider are the psychoses. These may be either the acute psychoses, where the patient tends to recover but to have remissions, or the deteriorating psychoses, where the down grade is gradual but continuous. The manic-depressives belong to the group of the acute psychoses. Here there is a definite change of mood in the individual. He may be in an asthenic, agitated or fear state. The involutional psychoses belong here also. This comes on about middle life. It is characterized by distractibility, flight of ideas and great activity.

Dementia precox belongs to the deteriorating psychoses, where there is gradual deterioration in the social level and mental ability. Of the dementia precox patients the hebephrenics show marked hallucinations, while the catatonics are characterized by stereotyped talk and actions, and have alternate periods of excitement and stupor.

The last state is the epileptic. This is also a deteriorating state dependent upon the number and severity of attacks.

THE HEALING OF FRACTURES

R. M. Janes, M.B.

Demonstrator in Clinical Surgery, University of Toronto.

Immediately following the fracture of a bone a varying amount of haemorrhage occurs. This haemorrhage arises from the torn vessels of the medulla, from the vessels in the periosteum, and from those vessels in the overlying soft tissues involved in the injury. The amount of haemorrhage is usually great in proportion to the apparent injury. The periosteum is torn from its attachment to the cortex for some distance on either side of the fracture. A blood clot is therefore formed bounded by the medulla, the ends of the broken cortex, the stripped-up periosteum and the overlying muscles and fasciae. As a result of being deprived of its blood supply through periosteum or nutrient artery, a microscopic portion of bone immediately adjacent to the fractured surface dies. This is evidenced from the fact that the lacunae are empty, the osteoblasts having disappeared.

The first steps toward the healing of a fracture do not differ from those noted in the healing of a similar lesion of other tissues. An increased blood supply to the part occurs as shown by swelling, perhaps some redness of the overlying tissues and by increased local heat. The blood clot is invaded by leucocytes and its absorption begins. Imme-

diately following this, and as the absorption of the blood clot continues, a proliferation of the capillaries and fibroblasts in the bone and overlying soft tissues commences, and the clot is gradually replaced by granulation tissue. It is probable that the osteoblasts, which a few days after a fracture are found to be very numerous in the region of fracture as compared with other areas in the bone, are capable of reverting to fibroblasts and taking part in this granulation tissue formation.

This process is not far advanced before new bone formation begins. This new bone formation is first seen on the surface of the bone from which the periosteum has been stripped, and about spicules of bone which have been broken off and yet have retained a blood supply. There is a gradual shading from new formed bone to new formed granulation tissue. There is a gradual change from a spindle-shaped fibroblast to the more or less stellate osteoblast with an increasing amount of homogeneous intercellular material as one comes closer and closer to parent bone. Other areas show the presence of a varying amount of cartilage. One finds an area of cartilage which shades on the one side into new formed bone, and on the other into new formed fibrous tissue. There is evidently a gradual transition from one type of tissue to the other. The amount of cartilage formed varies considerably. More seems to be formed in those fractures in which considerable movement is allowed than in those more completely immobilized.

It has been argued that the fibroblast, the chondroblast and the osteoblast are distinct cells, each incapable of assuming the activities of the other. Conceivably all of the osteoblasts of the new formed bone might be derived from the parent osteoblasts, but since no cartilage exists in the centre of the shaft of long bones a similar hypothesis will not account for the presence there of chondroblasts. That new bone may be formed apart altogether from the presence of adult bone is shown by the finding of deposits of bone in soft tissues which have been the seat of chronic inflammation for a long period of time. It would seem that the fibroblast, the chondroblast and the osteoblast represent different stages of activity of the same cell and that under special circumstances the fibroblast is capable of taking on the functions of the osteoblast or chondroblast and vice versa.

If, then, we examine the gross specimen of a fracture of a dog's radius at the end of two weeks we find considerable thickening about the site of fracture. New tissue fills the ends of the medullary cavities (the medullary plug or internal callus), intervenes between the fractured bone ends, and forms a sheath or ferrule about the fractured ends (the ensheathing callus). This new tissue consists largely of granulation tissue, but particularly about the bone ends there is present a definite amount of new irregularly formed bone and of cartilage. The fractured surfaces are held fairly firmly together, but bending still occurs easily at the site of fracture and any strong manipulation results in displacement.

The further progress of union merely consists in a continuation of the processes elaborated above. It would appear that new bone may be formed from cartilage or directly from fibrous tissue without the intervention of cartilage. Eventually a point is reached at which the ends of

the medullary cavity and the interval between the bone ends are occupied by loose trabeculae of new bone and there is a sheath of similar material about the site of fracture. The latter gives considerable strength to the union which is now sufficiently firm to allow the limb to be used without displacement of the fracture and without pain. It is at this stage that we are accustomed to consider the fracture united. This requires a varying length of time. Fractures through loose cancellous bone require a shorter length of time to heal than those through the shafts of long bones. Clinical experience has shown that certain fractures usually heal within certain periods; thus a Colles' fracture unites in three weeks, a fracture of the humerus in six to eight weeks, a fracture of the shaft of the femur in eight to ten weeks, and so on. When one regards the healing of fractures in the above light he is not more surprised that this process may take a little longer to reach the stage at which we are accustomed to consider function possible, than he is that a wound of soft tissues may take a rather unusually long time to heal. He will be very unlikely to advise any radical interference in a fracture which has not quite come up to expectations.

The completion of healing takes many months. It consists, in so far as possible, of a restoration of the bone to its former condition. The new bone between the fractured ends becomes increasingly dense; its lamellae accommodate themselves to the lines of stress and tend to take on the character of old shaft. The medullary plug is gradually absorbed by the osteoblasts, and the medullary cavity tends to be restored. The ensheathing callus is more or less completely absorbed, the completeness of absorption depending largely upon the accuracy of reduction of the fracture. If apposition of the bone ends is not reasonably accurate it is unlikely that the medullary cavity will be entirely restored. In young subjects a place may be reached eventually at which it is impossible to recognize the location of the fracture, although the bone at the site of healing usually becomes more dense than the remainder of the shaft.

From the foregoing description it becomes evident that the conditions necessary for the healing of fractures must be, reasonable restoration of position, relatively complete immobilization of the fragments, and the absence of any tissue between the fractured bone ends. It has been shown that a slight amount of movement does not interfere with union, but that much movement will result in a fibrous union and not a bony union.

The presence of sepsis in compound fractures was formerly regarded as sufficient excuse for failure to reduce fractures to the position in which one wished them to heal. It was found during the War that more new bone was frequently formed in the presence of a mild infection than in aseptic cases. It is therefore evident that all compound fractures should be put into proper position at as early a date as possible.

FACULTY NOTES

Rugby

After playing to a tie in 20 minutes' overtime in the semi-finals of the Mulock Cup, Sr. Meds. were finally defeated by Jr. School in a second game only after a second period of overtime.

Indoor Baseball

The Second and Fifth Years have won out in their respective groups, and meet on December 17th for the possession of the Silverthorne Cup. The manager of the winning team becomes the manager of the Medical team in the interfaculty series.

In **Basketball** Bob Cleghorn and Lorne Deeton have been elected managers of Jr. and Sr. Meds. teams, while in **Hockey** Red Mullin and Jimmie Mayne will look after Meds.' interests.

In the **Interfaculty Swimming** meet held recently Meds. are to be congratulated on their fine showing against the strong Arts team.

Medical Faculty Banquet

Some time in the middle of January the Medical Faculty Banquet will be held at Hart House, at which Dr. L. F. Barker, of Johns Hopkins, will speak. The date will be announced later.

PARKE, DAVIS & COMPANY'S

Pharmaceuticals, Biologicals and Gland Products are Standardized and of Highest Quality

---

CORRESPONDENCE INVITED ON ALL PHARMO-MEDICAL SUBJECTS

LABORATORIES

WALKERVILLE, ONTARIO

MONTREAL BRANCH—Read Building, 45 St. Alexander Street.
TORONTO OFFICE—422 Ryrie Building.
WINNIPEG DEPOT—Keewayden Building.

PHYSICIANS!

When you begin practice you are reminded that the Provincial Board of Health, Department of Health, Province of Ontario, supplies free of charge the following biological and other products used in the prevention and cure of disease:

(1) Small-pox, Pertussis and triple (typhoid and paratyphoid) vaccines.

(2) Diphtheria and tetanus antitoxins.

(3) Material for Schick test and toxin-antitoxin mixture.

(4) Antimeningitis serum.

(5) Preventive treatment for rabies and for babies' sore eyes (ophthalmia neonatorum).

(6) Insulin (for patients unable to pay).

(7) Phenarsenamine (606) and Mercury salicylate.

The foregoing as well as containers for blood, sputum, etc., may be obtained on application to any of the Board's Laboratories at Toronto, London, Ottawa, North Bay, Fort William, Owen Sound, Peterborough, Kingston, Sault Ste. Marie.

Further information supplied on application to

CHIEF OFFICER OF HEALTH,
SPADINA HOUSE,
TORONTO.